

# enFORCE

## Digital Servo Press DSP1500 (SAN3) SYSTEM OPERATION MANUAL



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SECOND Edition	July 2005
THIRD Edition	May 2007



Automation Systems

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DSP1500E-HS-2

## **\*\*WARNING\*\***

All applicable national and local codes must be followed when installing and operating the equipment detailed in this manual.

**FAILURE TO ABIDE BY THESE CODES AND THE SPECIFICATIONS DESCRIBED IN THIS MANUAL CAN RESULT IN SERIOUS INJURY TO PERSONNEL AND/OR DAMAGE TO THE EQUIPMENT.**



### **WARNING**

**THIS EQUIPMENT IS CAPABLE OF HIGH PRESS FORCE & VOLTAGES HAZARDOUS TO HUMAN LIFE.**

**DO NOT** operate the press **WITHOUT** all safety guards and/or devices in place and operational.

**NEVER** enter the press ram area with power applied to the press unit.

**Follow Lockout/Tagout and other safety precautions when performing maintenance or connecting / disconnecting cabling, wiring, and equipment.**

Do not open or remove any covers, even if the unit is disconnected from the power source.

Only qualified personnel should attempt to modify or repair this product.

There is a possibility of receiving an electrical shock from this equipment, if used improperly.



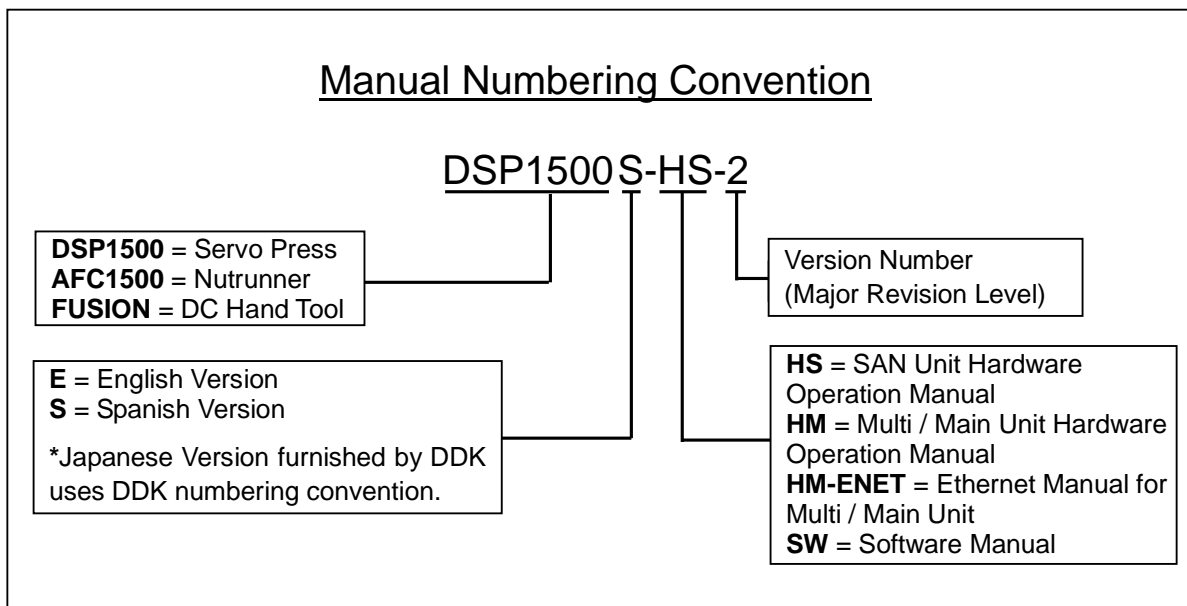
### **WARNING**

- Read this manual carefully before attempting to operate the equipment.
- If this System is being operated as a part of a larger system, the larger system should be clearly marked with the warning information, above. Also, a copy of this notice should be included in all pertinent operation and maintenance manuals.
- SAN Units must be placed in a NEMA 12 or similar enclosure. Some type of Air Handling Unit (air conditioner, heat exchanger, etc.) may also be required.
- Be sure to use the recommended circuit breakers with the power supply lines.
- Use the power supply voltages recommended in the specifications to prevent possible personnel injury and equipment damage.
- Operate equipment within the specified limits for force output and duty cycle. Exceeding these specifications could result in injury and/or shortened equipment life.
- Do not modify this equipment, or the warranty will be void. Please contact FEC INC. if any special modification is required.
- Inspect the equipment's safety devices and confirm they are operating properly. **DO NOT OPERATE EQUIPMENT IF THESE DEVICES MALFUNCTION!**
- Inspect the equipment for wear and damage at regular intervals.
- Use care when mounting or removing tools. Some tool models are very heavy.
- Avoid touching the moveable parts of the equipment. If this cannot be avoided, ensure that there is no power to the System before touching a moveable part.
- Specific precautions regarding equipment installation and location have been incorporated into this manual. Before operating the equipment, verify that countermeasures have been taken for any adverse conditions that may exist. Failure to address these conditions prior to operation could result in injury or damage to the equipment.

## Revisions

Revision	Revision Date	Revision History	Software Version*
1.0	06/2003	Initial Release	
2.0	07/2005	Correction Made to Initial Release	
3.0	05/2007	Revisions made for Version 2.x	2.17

\* Software Version at Revision Date.



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# Introduction

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Thank you for purchasing our **Digital Servo Press - DSP1500 System**.

This instruction manual describes the procedures for installation, wiring, handling, and actions to be taken in case of any failure.

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- ◆ This instruction manual shall be delivered to the end user who operates the equipment.
- ◆ Read all instructions before use, and always keep this instruction manual with the equipment.
- ◆ Items not described in this instruction manual shall be considered “unavailable”.
- ◆ The product specification and appearance described in this instruction manual is subject to change without notice.
- ◆ All rights reserved. Any disclosure, copying, distribution, or use of the information contained herein for other than its intended purpose, is strictly prohibited.

## For the safety of operator and equipment

- ◆ It is important for you to read all “Safety Precautions” before using the equipment, and understand and observe all instructions and recommendations included in this manual.
- ◆ Read all instructions and recommendations included in this manual, understand the functions and performance of this Servo Press, and correctly use this machine.
- ◆ Wirings and parameter settings shall only be conducted by a qualified professional.
- ◆ Never conduct a withstand voltage test or insulation resistance test on this equipment.
  
- ◆ Indicate the following on all instruction manuals that use this equipment.  
”**This equipment is capable of high voltages hazardous to human life.**”

## Points to check when unpacking

Please confirm the followings when unpacking this equipment.

- ◆ Ensure that you received the correct model, as ordered.
- ◆ Ensure that there are no missing parts.
- ◆ Check for any damage caused during transportation.

# Introduction

## Warranty

### Warranty Period

The standard warranty period is one year from the date of purchase or one year from delivery to the designated End User (not to exceed 18 Months). Actual terms are order specific.

### Provision of warranty

If your product proves to be defective, although it has been used properly in accordance with this instruction manual, during the period of warranty, this product will be repaired free of charge. However, in the following cases, the customer will be required to pay for repair charges, even for defects occurring within the warranty period.

1. Any defect due to improper conditions, improper circumstances, and improper handling.
2. Any defect due to modifications or repairs performed by the customer.
3. Any defect caused by other equipment.
4. Any defect caused by customer failing to meet the equipment's specification.
5. Any defect due to natural disasters and accidents.

This warranty shall be limited to repairing or replacing this product. Any liability for indirect or consequential loss or damage of any kind incurred or suffered by the customer due to a defect of the product is excluded.

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# **Chapter 1: Outline**

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## 1.1 About this Operation Manual

This manual details the configuration, specifications and the operation of the enFORCE Digital Servo Press System.

The following table outlines the contents of each chapter.

Chapter	Title	Contents
1	Outline	Basic characteristics and requirements of the enFORCE System.
2	Specifications	General specifications of the enFORCE System.
3	System Description	Description of standard and optional system components.
4	System Setup and Wiring	Equipment installation guidelines, dimensions, wiring, Input and Output signal descriptions and requirements for PLC programming.
5	Power Up and Initial Checks	Preliminary power on and operational tests.
6	System Operations	Instructions for the input of preset data and monitoring explanations.
7	Maintenance	Guidelines for preventative maintenance.
8	Troubleshooting	Description of abnormal conditions and corrective actions.

**Any questions regarding the contents of this document or any related matter should be directed to FEC Inc. at (586) 781-2100 or faxed to (586) 781-0044.**

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## Related Documentation

**DSP User Console Manual (Revision 2)**

Throughout this manual will be 2 types of note boxes used to magnify the importance of the subject being discussed:



Text boxes showing this symbol contain **Important** information or hints to aid in setup.



Text boxes showing this symbol contain **Caution** information and should be followed to avoid personal injury or damage to the equipment.

## **1.2 Features**

enFORCE is a Digital Servo Press System designed for use in both pressing and bonding applications in a low cost package. The system is a culmination of over twenty years of servo motor expertise based on our electric fastening system integrated with the latest digital servo technology.

### ☆ **Compact Design**

As the result of miniaturization circuit technology, the compact units maintain a maximum width of 123.5 mm (the largest model) in spite of the built-in power source and Servo Amplifier. System components are back panel mounted.

### ☆ **Pressing/Bonding**

Pressing and bonding are possible by load and distance control. Load, distance and force rate can be monitored.

### ☆ **32 Different Parameters (Work Selects)**

Total digitalized system eliminates analog potentiometers. 32 different set values of parameters are possible from the front panel and can be stored into Flash ROM. Battery backup of memory is not required.

### ☆ **Data Communication**

External communication is available through an RS485 port or the optional DP2 Keypad Display which has an RS232 port for outputting single press ASCII data. Connecting a group of presses (maximum of 31) to computers or setup equipment is also available through RS485. Parameter download and/or upload is possible through this port.

### ☆ **Motor**

A permanent magnet DC motor provides for improved press control and compact design. The sealed design of the motor provides greater protection from contamination. The resolver is designed to withstand harsh environments and provide high resolution control / distance feedback.

### ☆ **Preamplifier**

Quality control of the tool load transducer is accomplished electronically (digitally) through the EEPROM (Electrically Erasable Programmable Read Only Memory) in the preamplifier. During factory setup of the load transducer, the unit is dead weight and dynamically tested against Standards that are certified and traceable to the National Institute of Standards and Technology. The resultant data is then programmed into the preamplifier where it is stored on non-volatile EEPROM. TOOL-ID functions are also incorporated in the unit.

### ☆ **Servo Amplifier (Servo Drive)**

Reduced equipment size with improved drive circuit strength is the result of incorporating Isolated Gate Bipolar Transistor (IGBT) technology into the drive system.

### ☆ **Detachable Front Keypad Display**

An optional "hot-swappable" front Keypad Display is available for programming single units and/or monitoring the fastening results and status conditions of the system.

### ☆ **Self-Check Function**

The system self-checks the calibration of the load cell at the start of the press cycle to check whether the function of the unit cable and preamplifier is normal, thereby preventing abnormal pressing / bonding and damage to the tool etc.

### ☆ **Abnormal Condition Reporting**

When an abnormal condition occurs, a number code is displayed on the Keypad Display attached to the front panel of the associated SAN unit to aid in troubleshooting.

### **1.3 Safety Precautions**

To ensure the most effective and extended use of all equipment, adhere to the following precautions:

#### ➤ **Tool Installation**

- The tool generates a great amount of force during operation and the reaction force is applied to the mounting area of the tool. Therefore, tools must be installed in the proper position and with adequate bolts.
- The tool assembly contains precision parts and electric components, and must not be subject to excessive shocks or stresses. Use the supplied bolts to prevent the tool from loosening due to vibration.
- Keep in mind that the load cell is a strain gage based instrument and, although it has been designed to withstand sudden shock, repeated shock (over time) could damage the load cell.

#### ➤ **Pressing Operation**

- Avoid pressing beyond the rated full scale load. Even if the load is less than the maximum, be sure that the duty cycle is within the specified limits.

#### ➤ **Cable Wiring**

- Use only the specified cables for all system connections.
- When multiple enFORCE units are used, ensure that each SAN unit is connected to its matching numbered tool and that all connectors are locked.
- Do not use a high voltage circuit as a frame ground (FG). Also, the frame ground should be separate from the power ground. The use of a grounding rod located as close as possible to the enclosure housing the enFORCE controller unit (SAN) is preferable.
- Circuit breakers or fuses are required on branch circuit power feeds to the SAN units.
- PLC I/O cables must be run separate from any high voltage sources or cabling, and must not exceed 50 feet.

#### ➤ **Installation Environment**

- The enFORCE controller should be placed in a NEMA 12 enclosure.
- Using the equipment in the following locations may lead to malfunction or breakdown. Avoid using in these areas or use an air conditioner.
  - Areas under direct sunlight or if the environmental temperature is out of the 32~122°F (0~50°C) range.
  - Areas where relative humidity is out of the 20-90% range, the temperature change is drastic or where the area is exposed to mist and water drops.
- Do not use at the following locations. (Contact FEC Inc. if necessary for clarification)
  - Areas where conductive powder, oil, mist, salt or organic solvents exist.
  - Areas that have corrosive or combustible gases.
  - Areas that have strong electric or magnetic fields.
  - Areas where strong vibration or shock could be transmitted directly to a SAN unit or tool.

#### ➤ **Static Electricity**

- The enFORCE System incorporates many electronic Surface Mounted Devices (SMD). It is advisable to strictly adhere to practices for safe electrostatic discharge in order to prevent damage to the system components when handling them.

#### ➤ **Cleaning**

- Do not use any organic solvents, such as thinner, to clean a SAN unit or tool. The solvent could melt the surface paint, or penetrate inside and cause damage. A cloth dampened with alcohol or warm water should be used to lightly wipe the components.

➤ **Electrical Noise Prevention**




- SAN units must be located a minimum of 600mm from high transient voltage sources such as transformers, motor starters, AC inverters and AC contactors. If it cannot be avoided, the unit must be shielded.
- If high powered devices are used inside the enclosure, they must use a surge suppression device.
- Make sure that the power supply lines and cables for connecting the unit and tool are not run together inside the same duct.


➤ **Handling and Shipping**



- It is critical that enFORCE System components are properly handled and shipped in order to maintain the system's integrity. Adhere to the following requirements for shipping and handling:
  - Loose enFORCE System components must be individually packaged and shipped in anti-static containers or wrap to prevent damage from electrostatic discharge.
  - If the SAN unit is to be shipped in an enclosure, tighten all mounting screws to prevent the unit from being dislodged.
  - Do not package the tool with the weight of the unit resting on the press ram as damage to the load cell may occur.
  - The tool is heavy. Use lifting rings provided when necessary to move the tool.
  - Enclosure must be protected with shrink wrap.
  - Enclosure and system components should be shipped on an air ride trailer whenever possible.
  - All non-painted metal parts (except the electric motor and connectors) must be greased or oiled to prevent rust.
  - Do not ship or store the system components in environments where the temperature is out of the 23~131°F (-5~55°C) range or where the humidity is above 90%.


**1.4 Safety Labels**

Various labels are used on the SAN Unit and Press Tool to warn of possible harm or injury. These labels should be taken very seriously. Refer to the following page for label location.

	<b>DANGER</b>	<b>HIGH VOLTAGE:</b> Do not touch exposed connector terminal. May cause electric shock. Disconnect power before servicing.
	<b>CAUTION</b>	<b>HOT SURFACE:</b> Do not touch heatsink. May cause burn.
		Use proper grounding techniques. May cause electric shock.

	<b>DANGER</b>
	Pinch Point Watch your hands Keep away

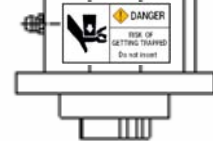
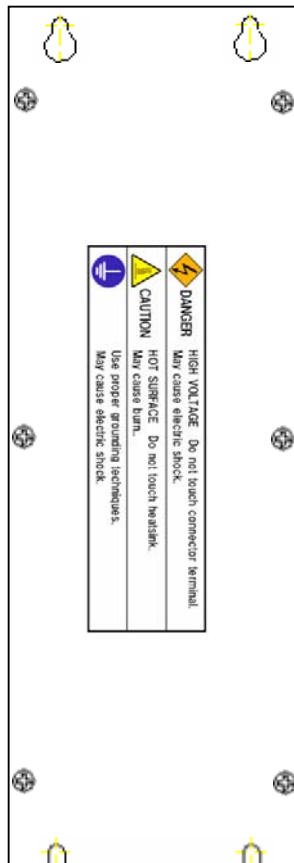
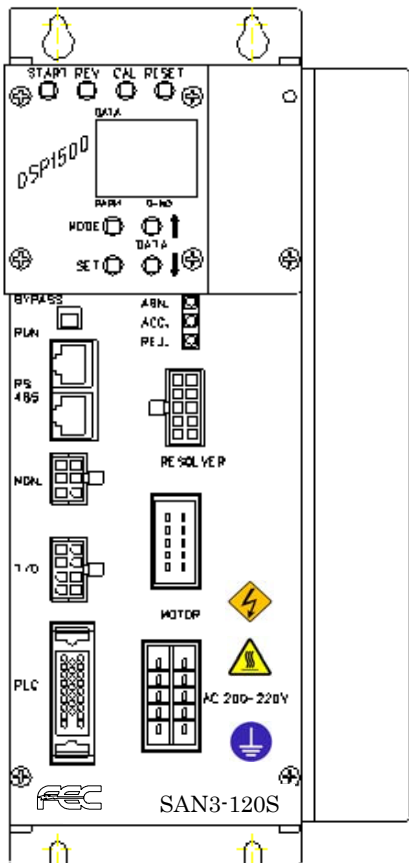
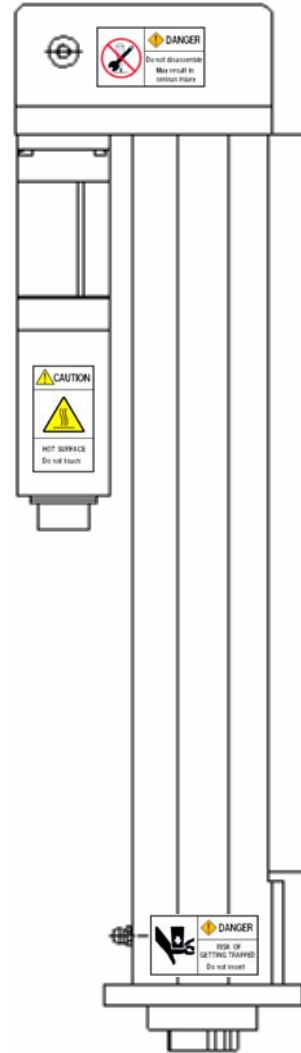
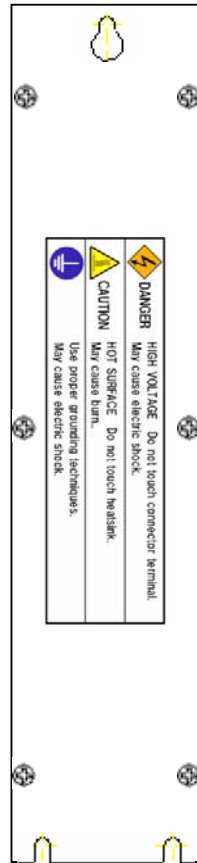
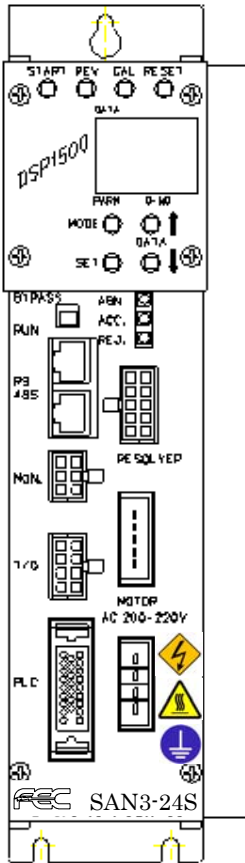
	<b>CAUTION</b>
	
	<b>HOT SURFACE</b> Do not touch

 ← HIGH VOLTAGE

 ← HOT SURFACE

 ← PROPERLY GROUND

	<b>DANGER</b>
	Do not disassemble May result in serious injury





## **Chapter 2: Specifications**

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**2.1 System Specifications**

<b>Power Supply Voltage</b>	180VAC ~ 242VAC, 3 phase, 50/60Hz
<b>Operating Conditions</b>	Temperature: 0 ~ 50°C (32 ~ 122°F) Humidity: 20-90%, no condensation
<b>Operating Range</b>	Duty Cycle less than 60%
<b>Storage Conditions</b>	Temperature: -5 ~ 55°C (23 ~ 131°F) Humidity: Below 90%, no condensation
<b>Shipping Conditions</b>	Temperature: -5 ~ 55°C (23 ~ 131°F) Humidity: Below 90%, no condensation
<b>Press Accuracy</b>	From 1/2 to full scale - 3 $\sigma$ less than 3% scatter of target load. From 1/4 to 1/2 of full scale load - 3 $\sigma$ less than 4% scatter of target load.
<b>Minimum Distance Display</b>	0.01mm (up to 99.99mm), 0.1mm (over 99.99mm)
<b>Distance Repeatability</b>	±0.01mm
<b>Force Transducer Accuracy</b>	±1% (0 – Full Scale)
<b>Linearity of Force Transducer</b>	±0.5% of Full Scale value (maximum)
<b>Operation Method</b>	Load Control / Distance Control

Force Needed	Motor Used	Required SAN Unit	Tool Type
Up to 0.2 ton	6 0 W	SAN3-24S	DPT-021R1-***FS
Up to 0.5 ton	8 0 W	SAN3-24S	DPT-051R2-***FS
Up to 0.5 ton	1 5 0 0 W	SAN3-120S	DPT-051R3-***PS
Up to 1.0 ton	2 0 0 W	SAN3-40S	DPT-101R3-***FS
Up to 1.0 ton	1 5 0 0 W	SAN3-120S	DPT-101R4H-***PS
Up to 1.5 ton	2 0 0 W	SAN3-40S	DPT-151R3-***FS
Up to 1.5 ton	1 5 0 0 W	SAN3-120S	DPT-151R4H-***PS
Up to 2.0 ton	2 0 0 W	SAN3-40S	DPT-201R3-***FS
Up to 2.0 ton	1 5 0 0 W	SAN3-120S	DPT-201R4H-***PS
Up to 3.0 ton	1 5 0 0 W	SAN3-120S	DPT-301R4H-***oS
Up to 5.0 ton	1 5 0 0 W	SAN3-120S	DPT-501R4H-***FS
Up to 5.0 ton	3 0 0 0 W	SAN3-120S	DPT-501R5-***PS
Up to 7.0 ton	1 5 0 0 W	SAN3-120S	DPT-701R4H-***FS
Up to 10.0 ton	3 0 0 0 W	SAN3-120S	DPT-102R5-***oS
Up to 15.0 ton	3 0 0 0 W	SAN3-120S	DPT-152R5-***oS
Up to 20.0 ton	3 0 0 0 W	SAN3-120S	DPT-202R5-***oS

## 2.2 SAN Unit Specifications

<b>CPU:</b>	32 bit RISC (Reduced Instruction Set CPU)
<b>Data Communication:</b>	RS485 (2 Ports) – 1 for DSP User Console Software
<b>Parameter / Firmware Storage:</b>	Flash ROM

SAN Unit Type	SAN3 - 24S		SAN3 - 40S	SAN3 - 120S	
Motor Type	RM1	RM2	RM3	RM4 H(B)	RM5(B)
SAN Unit Input Power	180~242VAC, 3φ				
SAN Unit Frequency	50/60HZ				
MAX. POWER OUTPUT	60W	80W	200W	1500W	3000W
IN-RUSH CURRENT	9.5A	18A	38.6A	79.2A	116.4A
SAN POWER CONSUMPTION	18W IDLE 31W IN CYCLE		18W IDLE 39W IN CYCLE		18W IDLE 109W IN CYCLE



After powering down wait at least 5 seconds (1 minute recommended) before powering up again. If the equipment is powered "ON" and "OFF" repeatedly without this delay, the in-rush current circuit will stop the unit from functioning. If this happens it may take up to five minutes before the unit will power up again.

### 2.2.1 Duty Cycle Calculation

Duty Cycle is rated as a percentage of the time the motor is running to the overall cycle time of the machine. This is an important factor in determining overload protection for servo amplifiers and motors as it directly relates to the amount of power or heat dissipation of the motor / servo package. The rated duty cycle for the enFORCE system is calculated as follows:

$$\text{Duty Cycle Percentage (\%)} = \frac{\text{Tool Pressing Time}}{\text{Total Cycle Time (Tool Pressing + Tool Waiting)}} \times 100$$

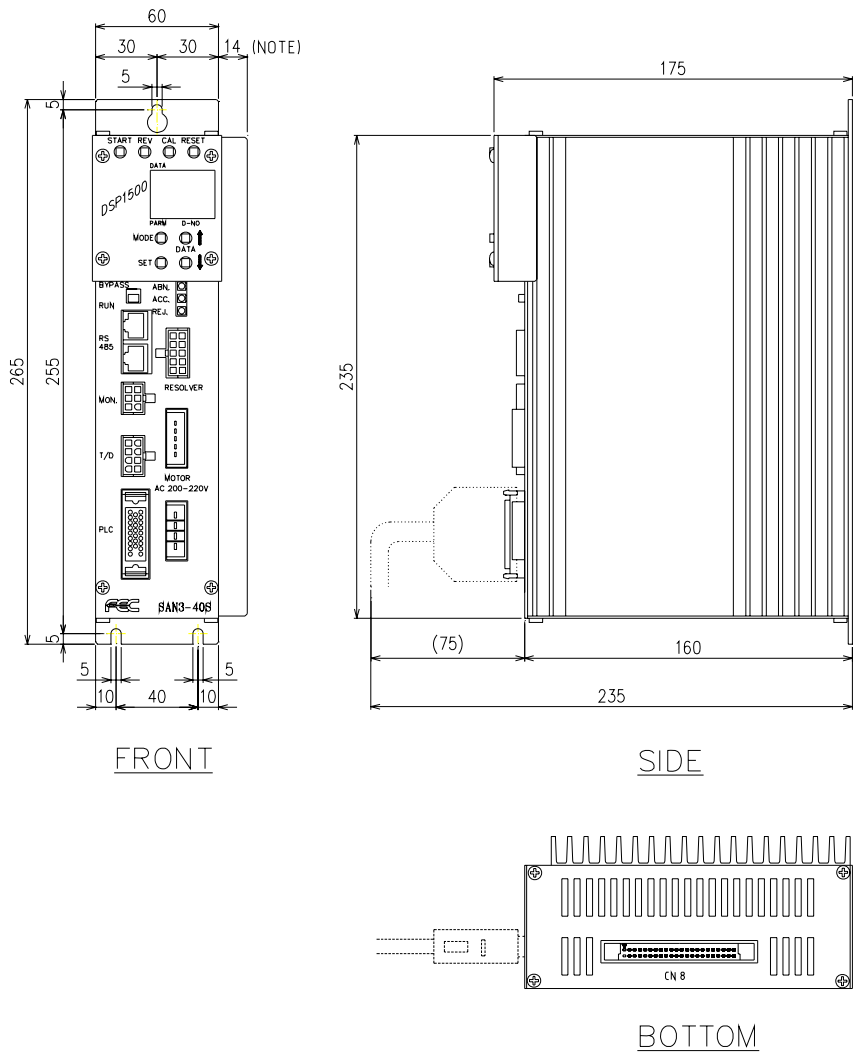
Duty cycle ratings vary between tools. As a general rule, however, it should not exceed 60%. If duty cycles remain above 60% for extended periods, a "Servo Amplifier Error / Overload" will result (see Abnormal Code 8-10). Protection for high duty cycle is a standard feature of the servo amplifier to prevent servo or motor damage.

### 2.2.2 SAN Unit Dimensions

#### SAN3-24S, SAN3-40S

Mounting: Top 1 place #8-32 screw  
 Bottom 2 places #8-32 screw

Weight: SAN3-24S - 1.4 kg  
 SAN3-40S - 1.8 kg

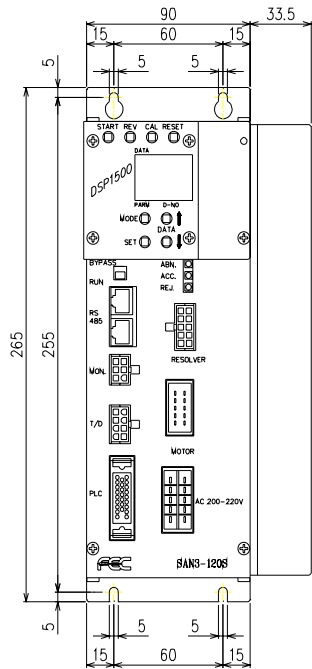


Note: The diagram shown above reflects dimensions for the SAN3-40S. The SAN3-24S does not have a heat sink plate so the width is 60mm as opposed to 74mm.

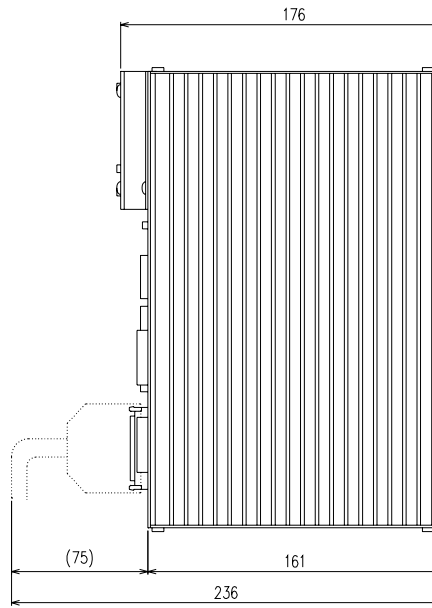
**SAN3-120S**

Mounting: Top 2 places #8-32 screw  
 Bottom 2 places #8-32 screw

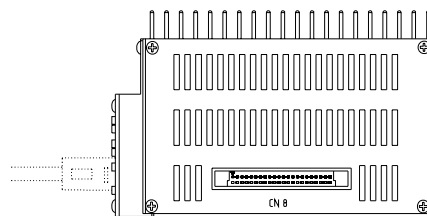
Weight: SAN3-120S - 3.6kg.



FRONT



SIDE



BOTTOM

## 2.3 Press Tool

### 2.3.1 Part Number Breakdown

DPT-[151]R[3][ ]-[25][F][S][B]-[00][A]  
 A B C D E F G H I

(A) PRESS FORCE (In Metric Tons)	020=0.2ton 050=0.5ton 101=1.0ton 151=1.5ton 201=2.0ton 301=3.0ton	501=5.0ton 701=7.0ton 102=10.0ton 152=15.0ton 202=20.0ton
(B) MOTOR	1 = RM1A 2A = RM2A 3 = RM3A 4 = RM4 4H = RM4H 5 = RM5	
(C) REVISION	BLANK = STANDARD MOTOR A, 3, ETC. = ALPHA NUMERIC REVISION CODE	
(D) STROKE	15 = 150mm 25 = 250mm	
(E) PRESS TYPE	F = PRESSING (Holding time <1sec.) P = BONDING (Holding time >1sec.)	
(F) SHAFT TYPE	S = SPLINE SHAFT G = GUIDE SHAFT	
(G) MAINTENANCE LOCK	B = WITH LOCK BLANK = NO LOCK	
(H) MOUNTING	00 = STANDARD (BACK MOUNTING) 01 = 90 DEGREES 02 = TAPPED 03 = FRONT MOUNTING 10 = SPECIAL (CUSTOM DESIGN)	
(I) VERSION/REVISION	A = CURRENT B = FUTURE UPGRADES C = FUTURE UPGRADES	

### 2.3.2 Tool Specifications

<b>Motor:</b>	Permanent magnet DC
<b>Force Monitor:</b>	Inline Load Cell
<b>Distance Monitor:</b>	High Resolution Resolver

#### List of standard tool for press-fitting (F type)

Use the following tools when operating with instantaneous load.

Tool No.	Tool type	Maximum load [KN]	Maximum speed [mm/sec]	Minimum speed [mm/sec]
30	DPT-021R1-**F	1.96	416.6	0.4
31	DPT-051R2-**F	4.90	333.3	0.3
32	DPT-101R3-**F	9.81	277.7	0.3
33	DPT-151R3-**F	14.7	277.7	0.3
13	DPT-151R4H-**F	14.7	277.7	0.3
43	DPT-201R3-**F	19.6	166.6	0.2
09	DPT-201R4H-**F	19.6	200.0	0.5
42	DPT-301R4H-**F	29.4	320.0	0.7
40	DPT-501R4H-**F	49.0	200.0	0.5
14	DPT-501R5-**F	49.0	194.4	0.6
41	DPT-701R4H-**F	68.6	133.3	0.3
37	DPT-102R5-**F	98.0	116.6	0.4
38	DPT-152R5-**F	147.0	77.77	0.22
39	DPT-202R5-**F	196.0	58.33	0.16

#### List of standard tool for press (P type)

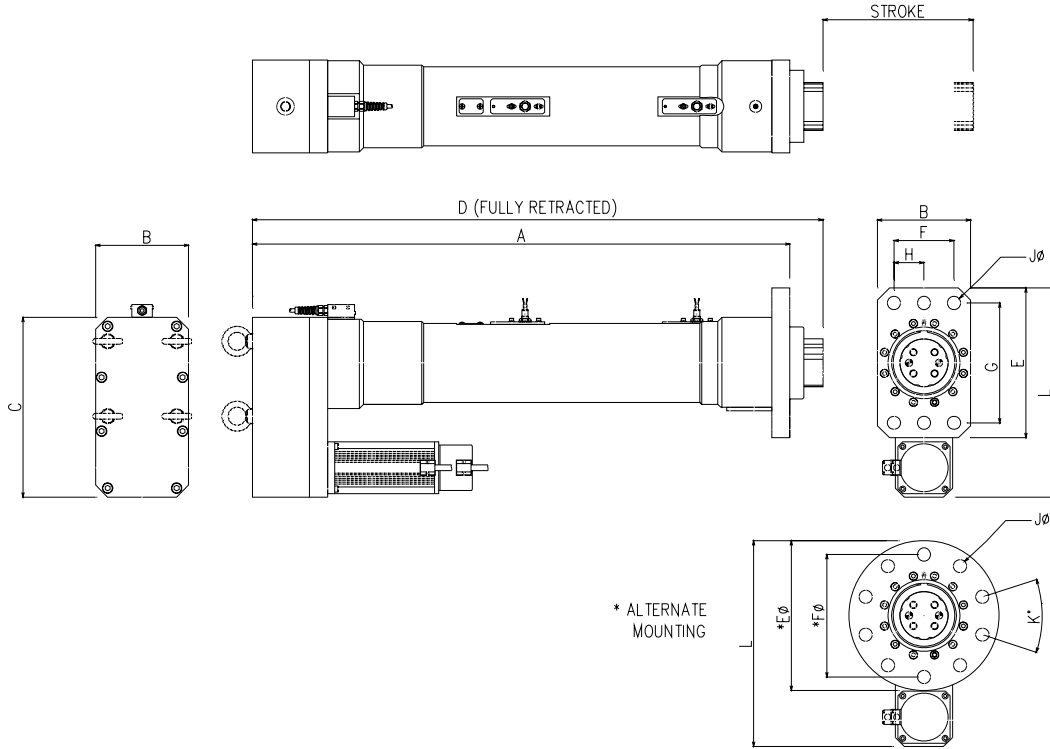
Use the following tools when operating while holding load.

Tool No.	Tool type	Maximum load [KN]	Maximum speed [mm/sec]	Minimum speed [mm/sec]
50	DPT-021R3-**P	1.96	208.3	0.2
65	DPT-051R3-**P	4.90	95.24	0.01
52	DPT-101R4H-**P	9.81	133.3	0.3
62	DPT-151R4H-**P	14.71	114.2	0.3
54	DPT-201R4H-**P	19.61	80.00	0.16
55	DPT-301R4H-**P	29.42	64.00	0.14
64	DPT-501R5-**P	49.03	58.33	0.17
63	DPT-102R5-**P	98.1	29.16	0.09
58	DPT-152R5-**P	147.1	22.22	0.06
59	DPT-202R5-**P	196.1	16.37	0.05

\*Standard part numbers shown. Contact FEC for non-standard part specifications.

1KN = 224.81 Lbs.

2.3.3 Tool Dimensions



Drawing Shown For Reference Only

TOOL NUMBER	STROKE	A	B	C	D	E	F	G	H	J	K	L
DPT-021R1-**F	150	432	60	126	449	85	45	70	N/A	9(4)	N/A	126
DPT-051R2-**F	250	665	85	160	695	140	50	115	N/A	14(4)	N/A	188
DPT-051R3-**P	250	663	85	160	695	140	50	115	N/A	14(4)	N/A	227
DPT-101R3-**F	250	690	110	205	735	180	75	145	N/A	18(4)	N/A	240
DPT-101R4H-**P	250	690	110	221.6	785	180	75	145	N/A	18(4)	N/A	240
DPT-151R3-**F	250	690	110	205	735	180	75	145	N/A	18(4)	N/A	240
DPT-151R4H-**P	250	690	110	205	735	180	75	145	N/A	18(4)	N/A	240
DPT-201R3-**F	250	690	110	210	735	180	75	145	N/A	18(4)	N/A	247
DPT-201R4H-**P	250	690	110	210	735	180	75	145	N/A	18(4)	N/A	247
DPT-301R4H-**F	250	744	128	229	789	180	90	140	N/A	22(4)	N/A	255
DPT-301R4H-**P	250	773	128	229	789	180	90	140	N/A	22(4)	N/A	304
DPT-501R4H-**F	250	885	155	264	940	250	100	200	50	22(6)	N/A	313
DPT-501R5-**P	250	885	155	322	940	250	100	200	50	22(6)	N/A	371
DPT-701R4H-**F	250	885	155	285	940	250	100	200	50	22(6)	N/A	334
DPT-701R5-**P	250	895	190	285	940	250	100	200	50	22(6)	N/A	415
DPT-102R5-**F	250	927	210	370	972	*330	*300	N/A	N/A	18(10)	36	432
DPT-102R5-**P	250	926	210	370	972	*330	*300	N/A	N/A	18(10)	36	505
DPT-152R5-**F	250	1007	230	425	1050	*380	*340	N/A	N/A	22(8)	45	500
DPT-152R5-**P	250	962	230	425	1050	*380	*340	N/A	N/A	22(8)	45	500
DPT-202R5-**F	250	1116	300	535	1050	*450	*410	N/A	N/A	26(8)	45	626
DPT-202R5-**P	250	1055	300	535	1050	*450	*410	N/A	N/A	26(8)	45	520

\*Standard part numbers and strokes shown. Contact FEC for non-standard part number dimensions. Dimensions shown are subject to change without warning due to design improvements.



## 2.4 Functions

- **Pressing Function**

The following press control methods can be selected for the enFORCE System.

1. Load Control
2. Distance Control
3. Specified Point Load Judgment
4. Load Rise Detection
5. Time Controlled Press
6. Load Drop Detection
7. Specified Range Peak Load Judgment
8. Load Drop Detection (Point Stop)
9. Distance Control with Load Limit

Load and Distance can be monitored in any configuration.

- **Part Checking – Interferences and Missing Parts**

If the parameters are set up for “Part Check Distance”, “Part Check Load High” and “Part Check Load Low”, interference and/or missing part checking will be performed.

Interference Checking - If a load greater than or equal to that programmed in “Part Check Load High” is measured before the press reaches “Part Check Distance”, the press operation will stop.

Missing Part Check – Once the press has reached “Part Check Distance”, if the load measured is less than that programmed in “Part Check Load Low”, the press operation will stop.

- **Self-Check Function**

If the SELF-CHECK OFF signal is HIGH (inactive or unconnected), the home-position (zero) voltage level and CAL (full scale) voltage level of the load cell are automatically checked before the cycle starts.

If the automatic system self-check of the load cell is not required, this function can be disabled by forcing the SELF-CHECK OFF signal LOW before the cycle starts.

When operating with the signal HIGH, the equipment will correct the zero load level so the equipment can adjust to external load changes, such as vacuum or gravity. The equipment will use the previous zero load level if the equipment was started with the signal LOW (Active).

- **Press Bypass Function (BYPASS)**

When the Bypass input signal is activated through a PLC or when the RUN/BYPASS switch on the front panel is switched to the Bypass position, the Bypass output signal is activated.

In this condition, the controller will not START. The SYNC signal will be in high impedance condition to avoid affecting synchronized operations.

If the unit is put into bypass mode when in cycle, it will stop functioning.

- **Reject (NG) / Abnormal Condition Display**

If a press reject or a system abnormal occurs, the tool will stop and output the appropriate signal. It will also display the resultant reject data or abnormal number on the front panel.

When a press reject occurs, the tool will return if programmed.

- **Tool Type Check Function**

The contents of the ID is read in the following conditions

- When a tool is already connected at the time of powering on.
- When the tool is connected and preset data is downloaded from a users console to the SAN unit.

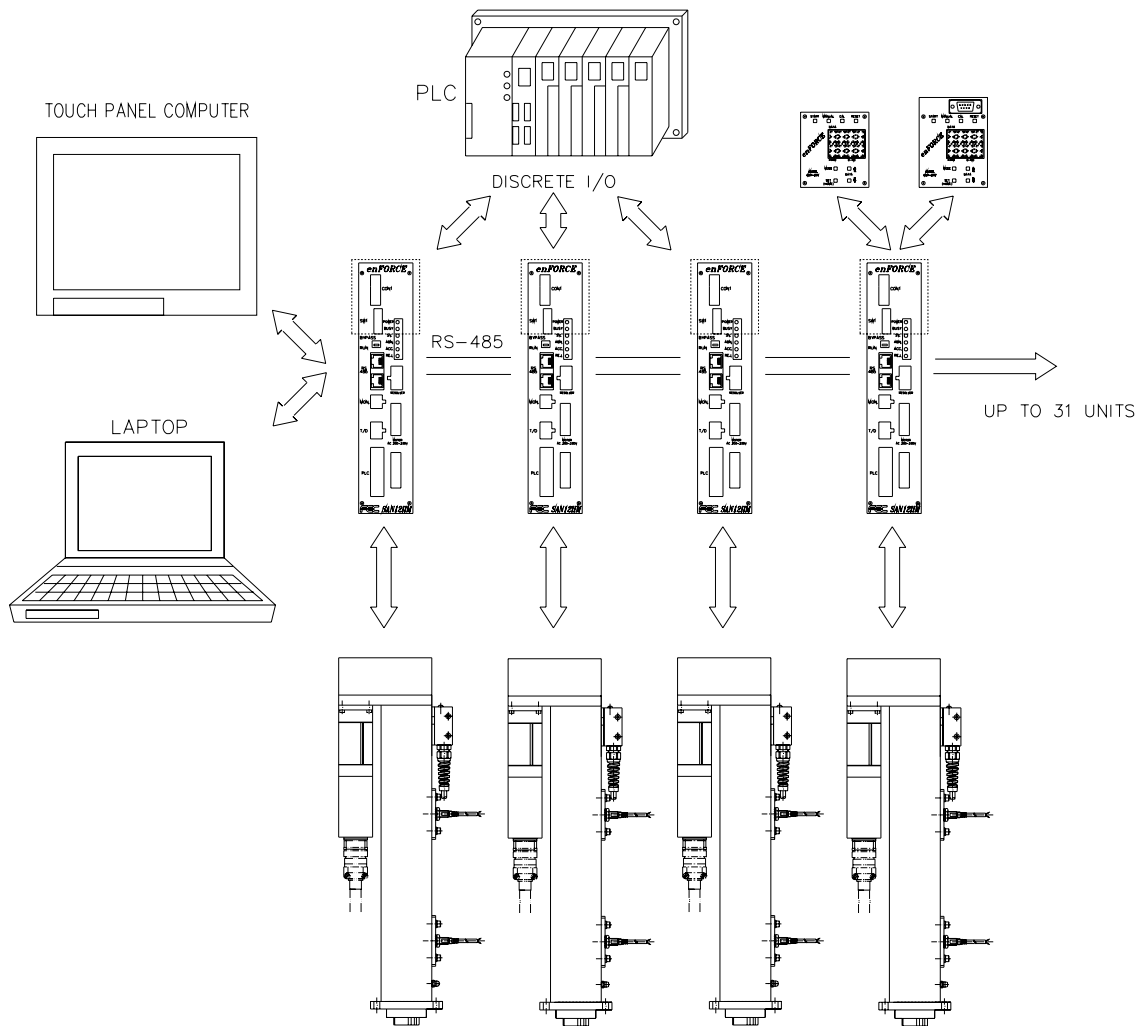
The tools have an EEPROM in the preamplifier that contains tool data specific for each tool. The tool type check function reads the information of the tool EEPROM and compares it to the information contained in the SAN unit; any mismatch is reported as a Tool Type Error Abnormal.



## **Chapter 3: System Description**

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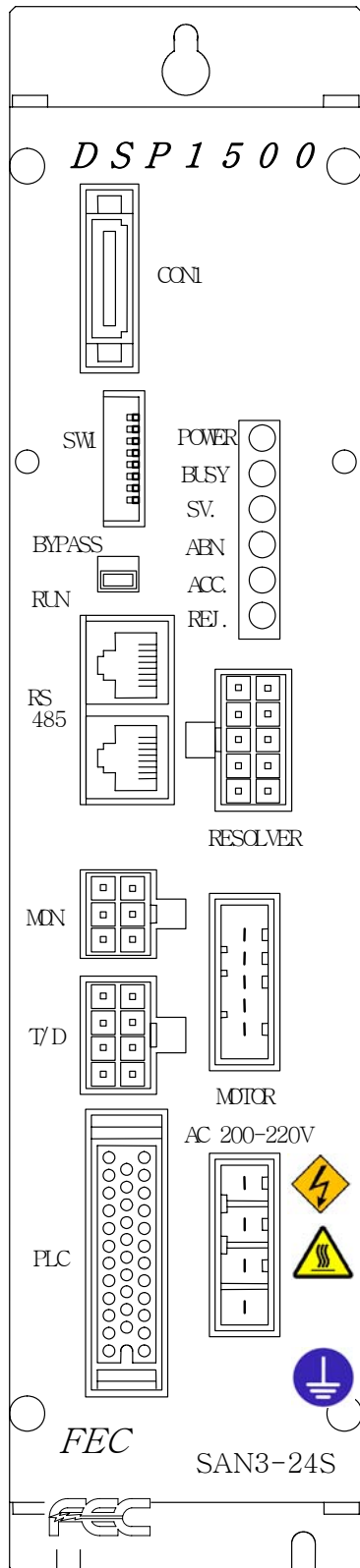
### 3.1 System Block Diagram



- ◆ The **enFORCE** system can consist of a stand alone unit or combined in a multiple press configuration. Discrete 24VDC (Sinking) I/O on the SAN unit provides direct communication with the PLC for individual or multiple press control.
- ◆ Press programming / monitoring can be accomplished using the “hot-swap” detachable keypad – for individual controllers, or by a PC running the DSP User Console software package – for simultaneous upload / download and monitoring of up to 31 SAN controllers via an RS485 series connection on the front of each SAN unit..

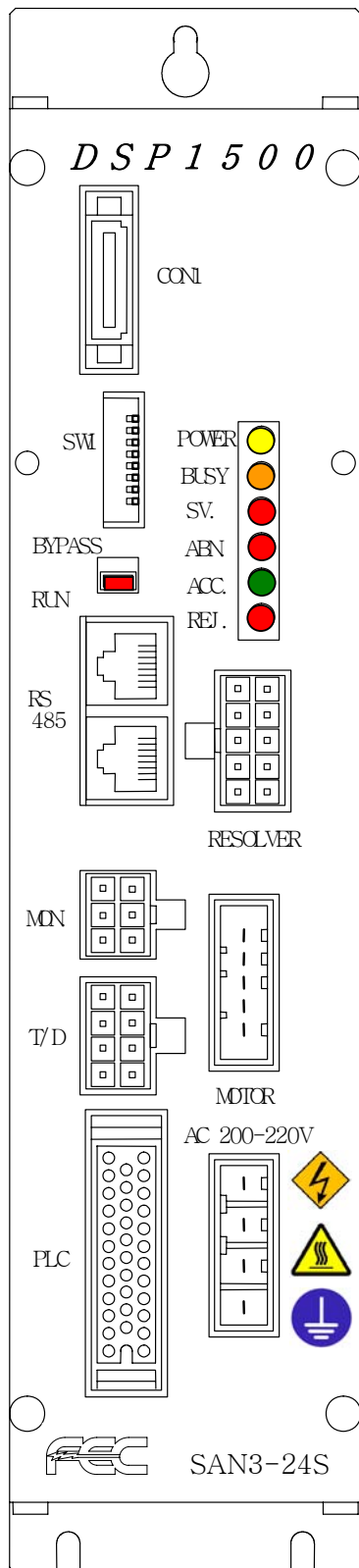
**3.2 DSP1500 Front Panel (enFORCE Controller)**

**3.2.1 DSP1500 Front Panel Switches and Connectors**



- CON1:** For Display Unit (SAN-DP\*S) connection.
- SW1:** Sets press number and special configuration features. (See Section 4.8)
- RUN/BYPASS:** Controller Enable/Disable switch.  
 RUN: Enable  
 BYPASS: Bypass Mode (Disable)
- RS485:** Bi-directional Communication ports.
- RESOLVER:** Resolver connection for tool Motor/Resolver cable.
- MON.:** (Monitor Output)  
 Pressure analog voltage and distance pulse output connection.
- T/D:** Connection for tool Load Cell cable.
- PLC:** Connection for I/O & Limit Sensor Cable. Connects to press limit sensors and PLC or Input-Output devices.
- MOTOR:** Motor Connection for tool Motor/Resolver cable.
- AC 200-220V:** Connection for Input Power. 3 phase, 180-242VAC, 50/60Hz

### 3.2.2 DSP1500 Front Panel Condition Display LED's



#### POWER LED (Yellow)

Lights when 180~242VAC input power is applied to the controller.

#### BUSY LED (Orange)

Lights up when in cycle

Blinks when returning

Blinks when running in MANUAL

Lights up when powering on and initializing

#### SV. [SERVO] LED (Red)

Lights up when a servo amplifier fault condition exists.

#### ABN. [ABNORMAL] LED (Red)

Lights up when an abnormal condition occurs

#### ACC. [ACCEPT] LED (Green)

Lights up when normal or within limits

#### REJ. [REJECT] LED (Red)

Lights up or blinks when exceeding judgment limit

Solid light: exceeding load control limits

Fast blink: exceeding distance control limits

Slow blink: exceeding load rate/time limits

#### BYPASS/RUN LED (Red)

Solid light when switch is in RUN position and not

receiving a BYPASS signal from an external source.

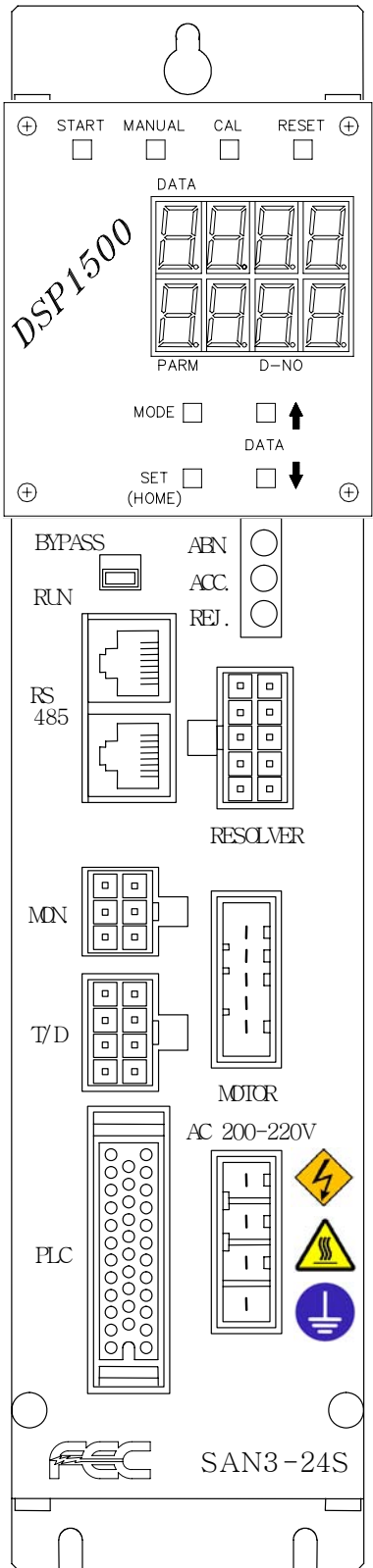
Blinking light when switch is in BYPASS position or

when a BYPASS signal from an external source is

received.

**\*Switch in BYPASS position overrides signal from an external source.**

**3.2.3 DSP1500 Detachable Keypad Buttons**



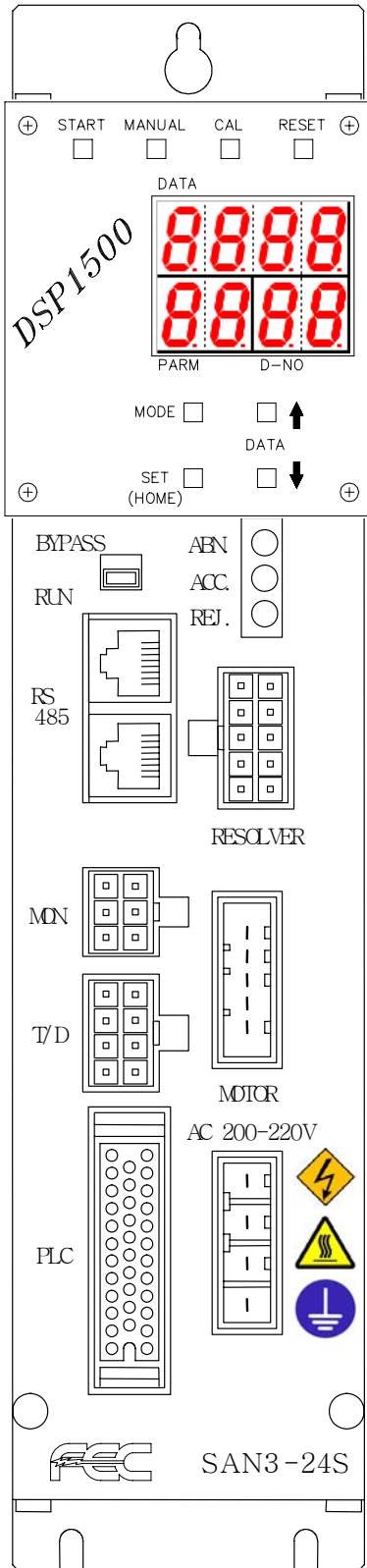
Operating Button

- START** Button
- MANUAL** Mode Button
- CAL** Manual Button
- RESET** Button

Data Display / (Operating) Button

- MODE** Button
- SET** Button (Home Return)
- DATA UP** Cursor Button (Manual Return)
- DATA DOWN** Cursor Button (Manual Advance)

**3.2.4 DSP1500 Detachable Keypad Condition Display**

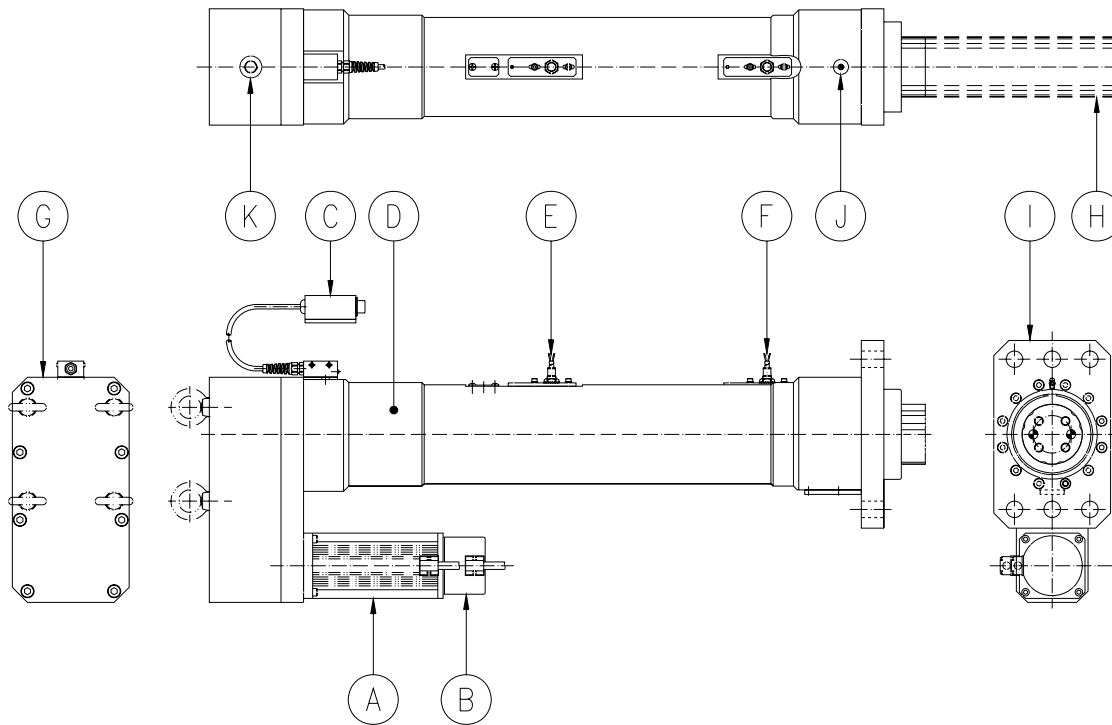


**DATA** Display (4 figure)  
Data Display (Load, Distance, etc.)

**PARAM** Display (2 figure)  
Parameter Number Display  
Or Abnormal Number Display

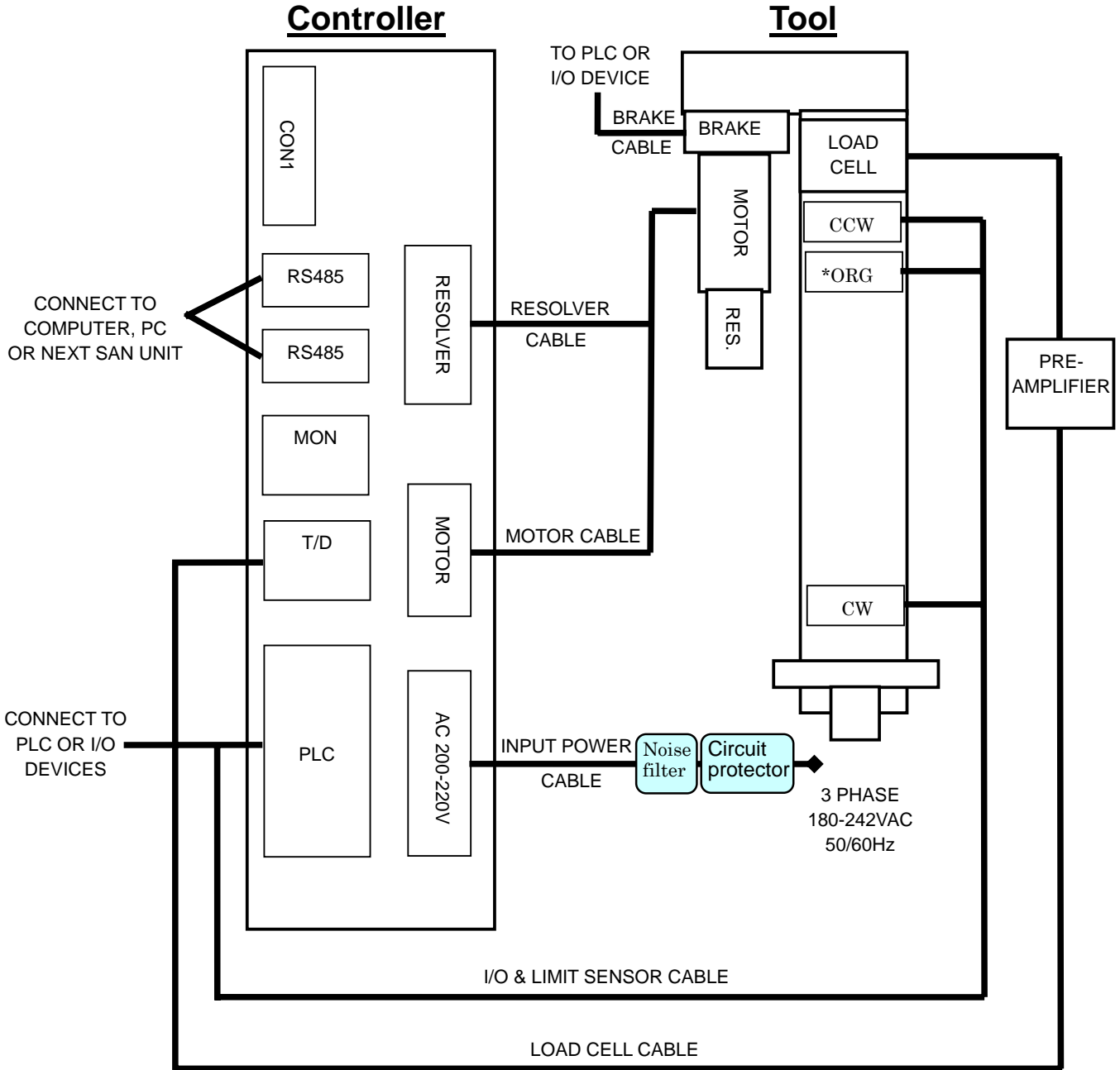
**D-NO** Display (2 figure)  
Data Number Display  
Press Unit Number Display  
Or Abnormal Sub-Code Number Display



**3.3 Press Tool**Drawing Shown For Reference Only

- |                             |                                                                                                                         |
|-----------------------------|-------------------------------------------------------------------------------------------------------------------------|
| A) MOTOR:                   | Totally enclosed DC permanent magnet motor<br>Refer to Chapter 2 for available motor sizes                              |
| B) RESOLVER:                | Provides feedback for speed regulation to servo amplifier<br>Provides distance monitoring capability to press operation |
| C) PRE-AMPLIFIER:           | Amplifies load transducer signal.<br>Houses "I.D. chip" used to verify tool functionality                               |
| D) LOAD CELL:               | Precision strain gage load transducer<br>Provides press force feedback to servo amplifier                               |
| E) HOME POSITION PROXIMITY: | Counter-clockwise (return) limit sensor                                                                                 |
| F) ADVANCED PROXIMITY:      | Clockwise (advance) limit sensor                                                                                        |
| G) GEAR HOUSING:            | Durable gear transmission                                                                                               |
| H) SPLINE:                  | Ball screw driven press ram                                                                                             |
| I) MOUNTING FLANGE:         | See Chapter 2 for size and hole pattern                                                                                 |
| J) GREASE FITTING:          | Spline (Rod) lubrication point.                                                                                         |
| K) LUBE ACCESS POINT:       | Gear lubrication point (availability and location dependant<br>on press size)                                           |

3.4 Connection Diagram



\*ORG Connection is for special applications.

## **Chapter 4: System Setup & Wiring**

#### 4.1 Design and Build Guidelines

**Review Chapters 1 and 2 prior to designing a System.** If requirements and specifications in these two chapters are not addressed, there is a possibility for degraded system performance.

No	ITEM	COMMENTS	Section Reference
1	Select the correct tool size	Keep force range between 50% and 75% of tool capability for press performance.	2.1, 2.3
2	Design tool mounting plate and press fixtures.	Design of mounting plate <b>MUST BE</b> stronger than the maximum capability of the press selected.	2.3
3	Select correct SAN Unit for the tool selected.	Different size tools require different size SAN Units. Ensure the correct one is selected.	2.1, 2.2
4	Select adequate circuit protection	Circuit protection for the SAN Unit should be separate from other devices.	4.3
5	Select an air handling unit as required. (Air Conditioner, Heat Exchanger, etc.)	Select a unit applicable to the environmental conditions.	2.1
6	Select adequate PLC hardware if required.	PLC must facilitate direct connection to the enFORCE system I/O (24VDC true low).	4.7, 4.14
7	Design PLC logic	PLC program can be written using signal descriptions and timing charts provided.	4.7, 4.14
8	Select NEMA 12 enclosure and backpanel.	Backpanel must be large enough to allow adequate space between SAN units.	4.2
9	Set SAN Unit DIP switches	Verify the SAN Unit address and special functions setting.	4.8
10	Mount SAN Units onto backpanel.	Mount with adequate spacing between each unit and between unit and other devices.	4.2
11	Wire input power connections.	<b>VERIFY VOLTAGE PRIOR TO APPLYING POWER.</b>	4.4
12	Wire I/O Connections.	<b>VERIFY VOLTAGE SOURCES PRIOR TO CONNECTION &amp; AGAIN BEFORE POWER UP.</b>	4.7
13	Route homerun & extension cables.	<b>ADHERE TO CABLE INSTALLATION GUIDELINES</b>	4.12
14	Connect homerun & extension cables to SAN Unit and tool.	<b>VERIFY POWER IS OFF.</b> Connect cables for tool motor power, resolver, transducer, limit sensors and brake if required.	3.4, 4.5, 4.6, 4.13
15	Power up the equipment.	<b>VERIFY WIRING &amp; VOLTAGES OF ALL POWER SUPPLIES PRIOR TO POWER UP.</b>	Chapter 4
16	Input preset data.	Set the preset data for force, distance, speed, time, etc. according to customer specifications.	Chapter 6
17	Perform initial checks.	Set Stop signal high & Work Select signals low. Verify there are no obstructions in the press ram travel path.	5-2
18	Verify normal operation.	Confirm automatic operation.	5-2

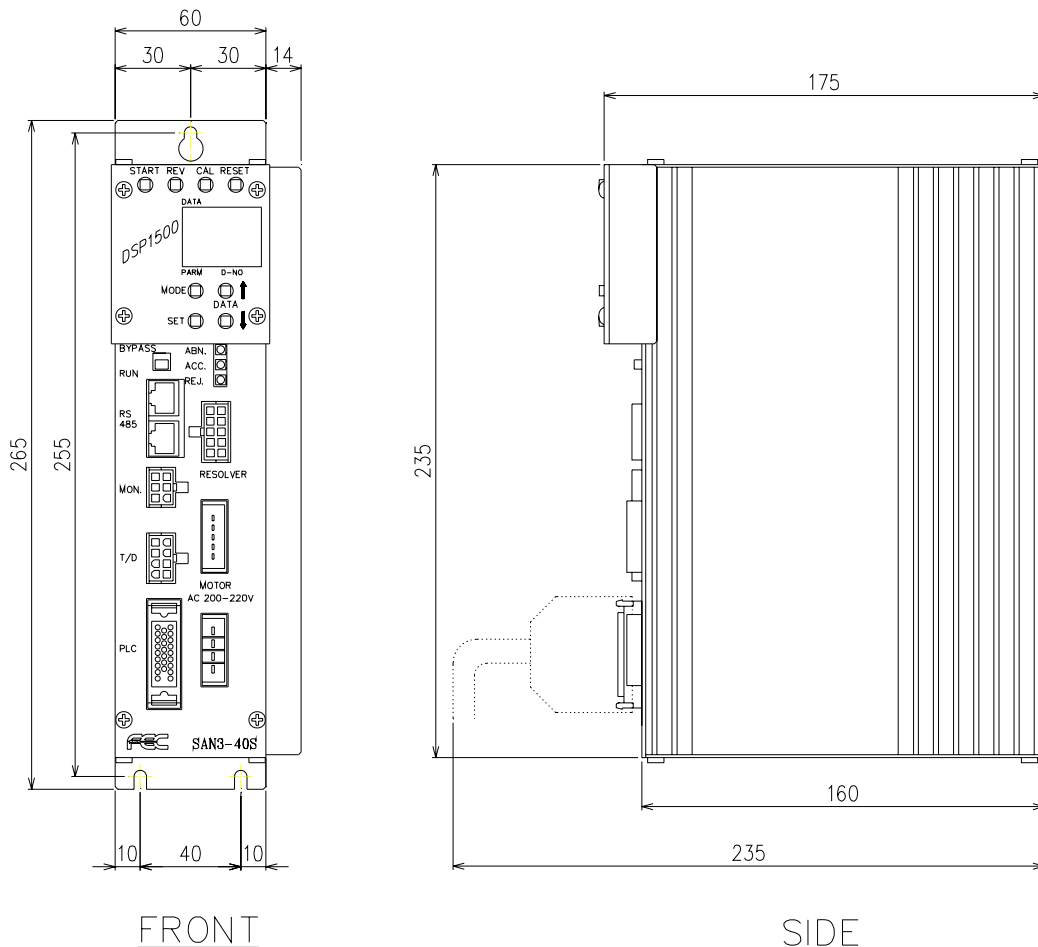
### 4.2 SAN Unit Design and Mounting Dimensions

SAN units must be mounted with a minimum clearance of 12mm on each side to allow proper heat dissipation. Cable connections on the front of the units require 100mm of clearance. Allow a minimum of 100mm clearance on the bottom of each controller for cable hook up when updating firmware. SAN units must be located a minimum of 600mm from any high transient voltage power source.

**SAN3-24S, SAN3-40S**

Mounting: Top (1) place #8-32 screw  
 Bottom (2) places #8-32 screw

Weight: SAN3-24S - 1.4 kg  
 SAN3-40S - 1.8 kg

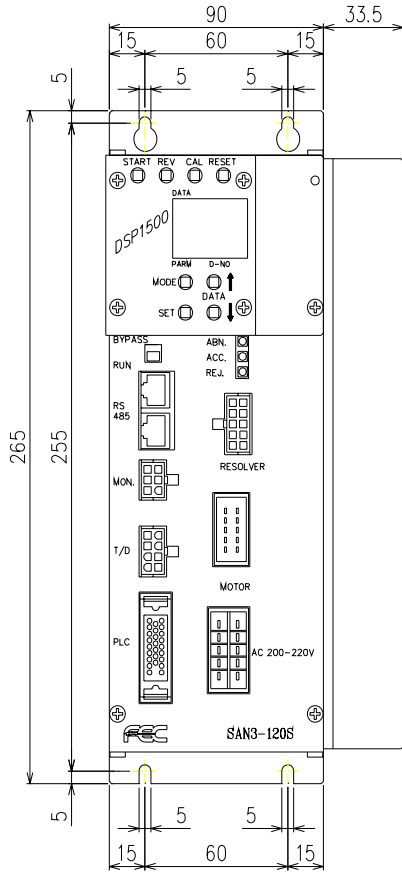


The diagram shown above shows the dimensions of the SAN3-40S. The protrusion of the heat sink plate (14mm) is on the SAN3-40S only, therefore the width of the SAN3-24S is 60mm as opposed to 74mm.

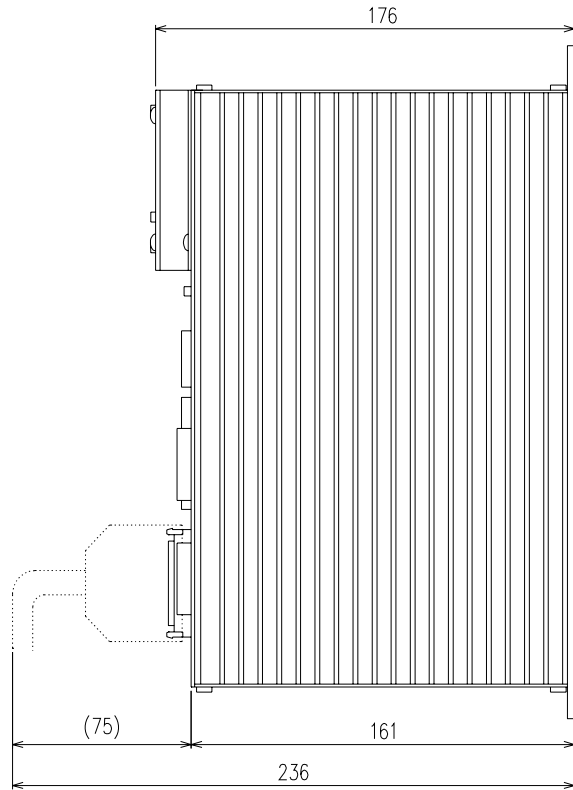
**SAN3-120S**

Mounting: Top (2) places #8-32 screw  
 Bottom (2) places #8-32 screw

Weight: SAN3-120S - 3.6 kg



FRONT



SIDE

### 4.3 Calculating Circuit Protection

RATED VALUES FOR CALCULATING CIRCUIT PROTECTION				
MOTOR TYPE	MOTOR WATTAGE	SAN3 UNIT	# OF SAN3 UNITS PER 1 KVA	KVA PER SAN3 UNIT
R1	60	SAN3-24S	8	.125
R2	80	SAN3-24S	6	.167
R3	200	SAN3-40S	2.5	.40
R4	1500	SAN3-120S	0.5	2.0
R5	3000	SAN3-120S	0.25	4.0

The chart above shows nominal motor ratings for standard press motors, along with the power requirements for each SAN unit. Use the formula below to calculate transformer secondary fuse or circuit breaker sizes.

$$1.5 \times \left[ \frac{\text{Transformer (VA)}}{\text{Secondary Voltage}} \right] \div \sqrt{3} = \text{Secondary Fuse Size}$$

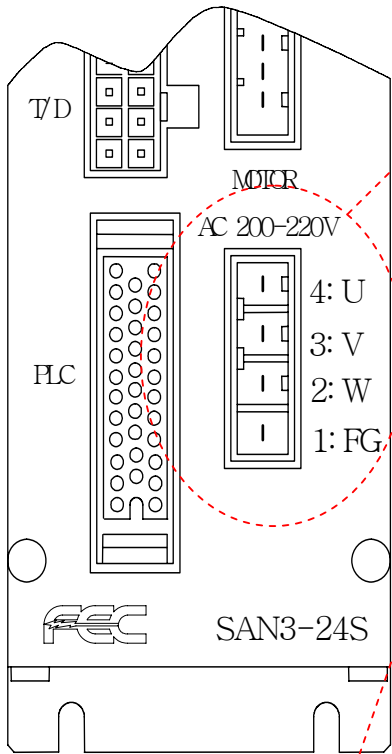
Example:

$$1.5 \times \left[ \frac{1000 \text{ (VA)}}{200 \text{ VAC}} \right] \div \sqrt{3} = 4.33 \text{ Amps (Use 5 Amp Fuses)*}$$

\* Use a fuse or circuit breaker with the next available highest rating. Due to the high inrush current at power up, it is recommended to use "Slow Blow" type fuses or fuses rated for motor loads such as Bussman type FRS or FRN.

### 4.4 Input Power Supply Connection

Adequate circuit protection must be provided for the SAN unit input power.  
 Recommended conductor size should be a minimum of #16AWG.  
 Suggested color code (FEC standard): U – Red, V – White, W – Black, FG – Green.



#### Wiring Chart

##### SAN3-24S, 40S

- 4 : U
- 3 : V
- 2 : W
- 1 : FG

3-Phase  
 180 ~ 242VAC  
 50/60Hz.

##### SAN3-120S (Shown Below)

- A 5 : U    B 5 : U
- A 4 : V    B 4 : V
- A 3 : W    B 3 : W
- A 2 : NC    B 2 : NC
- A 1 : FG    B 1 : FG

3-Phase  
 180 ~ 242VAC  
 50/60Hz.

\*Connect wires to both the A side and B side.

#### Mating Connectors

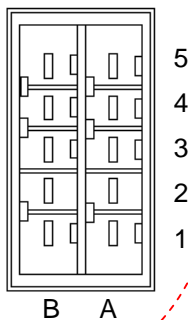
##### SAN3-24S, 40S

- Manufacture: AMP
- Housing Part No.: 1-178128-4
- Contact Part No.: 1-175218-3 (Qty.-4)

##### SAN3-120S

- Manufacture: AMP
- Housing Part No.: 1-917659-5
- Contact Part No.: 1-917511-3 (Qty.-8)

##### SAN3-120



**Install adequate circuit protection on the input power feed. (Refer to Appendix A for wiring)**  
**When using a transformer that is not isolated or if incoming power is known to be noisy, install a filter in the input power circuit. Recommended Filters:**

- SAN3-24S                    TDK #ZRWT2205-ME**
- SAN3-40S                    TDK #ZRWT2210-ME**
- SAN3-120S                  TDK #ZRWT2220-ME**



### 4.5 Motor Power-Resolver Connections

The motor connector provides control power to the motor. The resolver connector handles the signals that define the rotation of the motor. The controller provides a signal to the winding of the rotor. As the rotor spins two sets of stators, electrically shifted 90 degrees, generate a sine wave and a cosine wave signal. Both signals are processed by the controller to define position and speed of the motor. The signals for the motor and resolver are contained in one cable. See Section 4.13 and Appendix A for connecting cable part numbers and specifications.

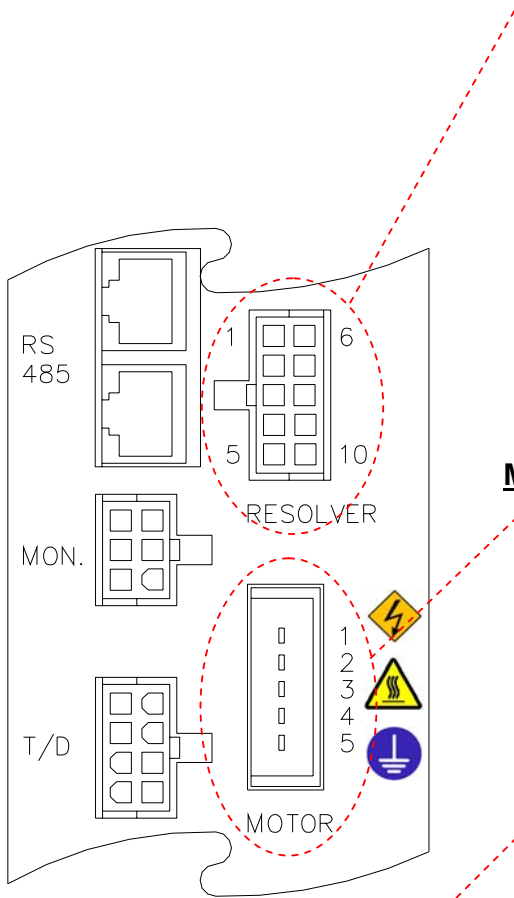
#### RESOLVER

##### Wiring Chart

- |                |                |
|----------------|----------------|
| 1: (R1) Rotor  | 6: (R2) Rotor  |
| 2: (S2) Stator | 7: (S4) Stator |
| 3: (S1) Stator | 8: (S3) Stator |
| 4: Not Used    | 9: Shield      |
| 5: Not Used    | 10: Not Used   |

##### Mating Connector

- |                   |                     |
|-------------------|---------------------|
| Manufacture:      | Molex               |
| Housing Part No.: | 39-01-2105          |
| Contact Part No.: | 39-00-0047 (Qty.-7) |



#### MOTOR

##### Wiring Chart

##### SAN3-24S, 40S

- 1: Frame Ground
- 2: Not Used
- 3: W Phase
- 4: V Phase
- 5: U Phase

##### SAN3-120S (Shown Below)

- |                 |                 |
|-----------------|-----------------|
| 1: Frame Ground | 6: Frame Ground |
| 2: Not Used     | 7: Not Used     |
| 3: W Phase      | 8: W Phase      |
| 4: V Phase      | 9: V Phase      |
| 5: U Phase      | 10: U Phase     |

##### Mating Connectors

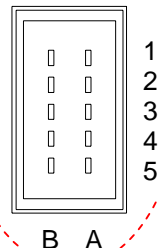
##### SAN3-24S, 40S

- |                   |                     |
|-------------------|---------------------|
| Manufacture:      | AMP                 |
| Housing Part No.: | 1-178288-5          |
| Contact Part No.: | 1-175218-3 (Qty.-4) |

##### SAN3-120S

- |                   |                     |
|-------------------|---------------------|
| Manufacture:      | AMP                 |
| Housing Part No.: | 1-178289-5          |
| Contact Part No.: | 1-175218-3 (Qty.-8) |

##### SAN3-120



## 4.6 Pre-Amplifier Connection

The pre-amplifier connector links the SAN controller to the tool load cell in order to perform the following functions:

1. Reads the load voltage values from the pre-amplifier.
2. Tests the pre-amplifier condition by generating a voltage signal for full scale load by the Calibration function.
3. Tests the Pre-amplifier Zero level by the Zero Level Check function.

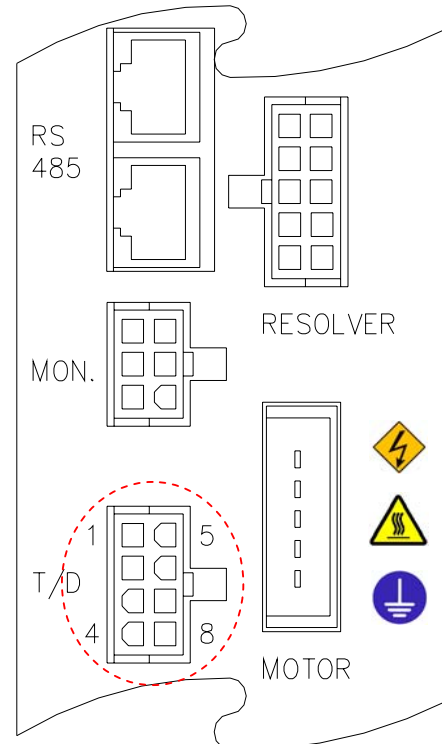
See Section 4.13 and Appendix A for connecting cable part numbers and specifications.

### Wiring Chart

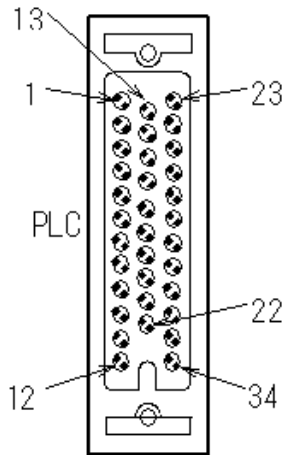
1: (SCL) Signal Clock	5: Frame Ground
2: (SDA) Signal Data	6: Ground
3: (CAL) Calibration	7: -12VDC
4: Load Input	8: +12VDC

### Mating Connector

Manufacture:	Molex
Housing Part No.:	39-01-2085
Contact Part No.:	39-00-0047 (Qty.-8)



**4.7 External-Control Signal Connection**



**Mating Plug**

Manufacturer : Honda Tsushin Kougyo (HONDA)  
 Vertical Housing Part No.: MR-34L  
 Male Insert Part No.: MR-34M  
 (See Appendix A for connecting cable part numbers)

**4.7.1 PLC I/F (AXIS I/O) Signal**

Pin No.	Signal Name	IN/OUT	Description
1	STOP	IN (N.C.)	Stops System operation upon loss of signal.
2	RESET	IN (N.O.)	Resets to the initial condition. (>100 ms pulse)
3	MANUAL	IN (N.O.)	Manual mode.
4	START	IN (N.O.)	Starts Press Cycle.
5	BYPASS	IN (N.O.)	Disables Press operation.
6	NOT USED		No Connection Allowed
7	NOT USED		No Connection Allowed
8	NOT USED		No Connection Allowed
9	HOME / BANK1	IN (N.O.)	Home sensor input(Use for special applications)/Bank 1 Select.
10	OPTION IN	IN (N.O.)	※Use when inputting option and special specification
11	BANK0	IN (N.O.)	Bank 0 Select input
12	NOT USED		No Connection Allowed
13	IN COMMON		Input signal common. (+12 ~ +24VDC)
14	SELF CHECK OFF	IN (N.O.)	Disable the self-check function.
15	CW LIMIT	IN (N.C.)	CW limit sensor input. (Advance limit)
16	CCW LIMIT	IN (N.C.)	CCW limit sensor input. (Return limit)
17	WORK SELECT 0	IN (N.O.)	These 5 inputs form a binary code which is capable of selecting up to 32 different parameters. (In Manual Mode these inputs become selecting signals for advance, return, home-position search and home-position return operations.)
18	WORK SELECT 1	IN (N.O.)	
19	WORK SELECT 2	IN (N.O.)	
20	WORK SELECT 3	IN (N.O.)	
21	WORK SELECT 4	IN (N.O.)	
22	OUT DATA11	OUT (N.O.)	Echo of Bank 0 Select Signal
23	OUT COMMON		Output signal common. (0V/DV)
24	OUT DATA0	OUT (N.O.)	Outputs system condition signals based on which Bank is selected.
25	OUT DATA1	OUT (N.O.)	
26	OUT DATA2	OUT (N.O.)	
27	OUT DATA3	OUT (N.O.)	
28	OUT DATA4	OUT (N.O.)	
29	OUT DATA5	OUT (N.O.)	
30	OUT DATA6	OUT (N.O.)	
31	OUT DATA7	OUT (N.O.)	
32	OUT DATA8	OUT (N.O.)	
33	OUT DATA9	OUT (N.O.)	
34	OUT DATA10	OUT (N.O.)	Echo of Bank 1 Select Signal

IN: Input Signal    OUT: Output Signal    NC: Normally Closed    NO: Normally Open



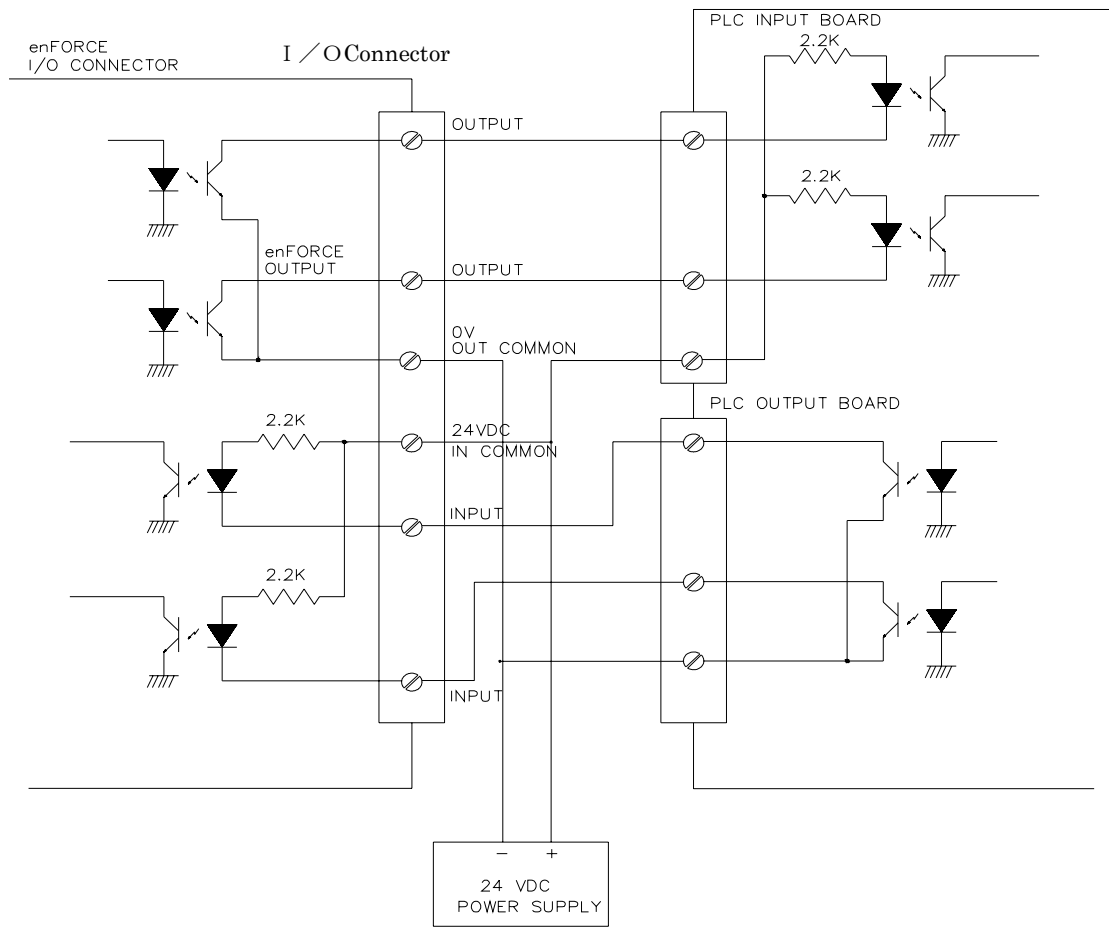
System Parameter 00, D-No. 08 – HOME SENSOR/BANK1 signal is normally “BANK 1”.  
 To enable Output Banks 2 & 3, set Parameter 00-08 to ‘2’. (See Page 6-22)  
 If using the CYCLE OK signal, BANK 1 output is not available in Bank 1.



**The BUSY signal is normally used to operate the brake. When changing Banks, the meaning of the BUSY signal will change when a bank other than Bank 1 is selected. (See Section 4.14 for Brake Operation)**

BANK1	BANK0	OUT DATA	Signal Name	Description	
OFF	OFF	OUT DATA0	BYPASS	Output when press is in BYPASS	
		OUT DATA1	ORG OK	Output after home position has been defined.	
		OUT DATA2	POS STOP	Output when the cylinder is stopped in home position.	
		OUT DATA3	BUSY	Output while operating.	
		OUT DATA4	READY	Output when the system is READY to operate.	
		OUT DATA5	ABNORMAL	Output when an Abnormal condition occurs.	
		OUT DATA6	ACCEPT	Output when the system has halted without failure.	
		OUT DATA7	REJECT	Output when the system has halted with failure.	
		OUT DATA8	ADVANCED	Output when the press has reached target load or distance.	
		OUT DATA9	TIMING	Output timing signal. Used when Par. 00, D-No. 0A is set.	
		OUT DATA10	CYCLE OK/BANK1	Output when the press reaches the distance set in Param. 00, D-No. 0A (1~9) / Output echo of Bank Select 1 Input.	
		OUT DATA11	BANK0	Output echo of BANK Select 0 Input.	
OFF	ON	OUT DATA0			
		OUT DATA1			
		OUT DATA2			
		OUT DATA3	WORK SELECT 4	Output echo of selected Input.	
		OUT DATA4	WORK SELECT 3		
		OUT DATA5	WORK SELECT 2		
		OUT DATA6	WORK SELECT 1		
		OUT DATA7	WORK SELECT 0		
		OUT DATA8			
		OUT DATA9			
		OUT DATA10	BANK1	Output echo of BANK Select 1 Input.	
		OUT DATA11	BANK0	Output echo of BANK Select 0 Input.	
ON	OFF	OUT DATA0	LOAD_LOW	Output on a Low Load Reject.	
		OUT DATA1	LOAD_HIGH	Output on a High Load Reject.	
		OUT DATA2	Rt2_LOW	Output on a Rate 2 Low Reject	
		OUT DATA3	Rt2_HIGH	Output on a Rate 2 High Reject	
		OUT DATA4	Rt1_LOW	Output on a Rate 1 Low Reject	Both ON: 1 <sup>ST</sup> Zone Reject
		OUT DATA5	Rt1_HIGH	Output on a Rate 1 High Reject	
		OUT DATA6	DIS_LOW	Output on a Low Distance Reject	
		OUT DATA7	DIS_HIGH	Output on a High Distance Reject.	
		OUT DATA8			
		OUT DATA9			
		OUT DATA10	BANK1	Output echo of Bank Select 1 Input.	
		OUT DATA11	BANK0	Output echo of Bank Select 0 Input.	
ON	ON	OUT DATA0			
		OUT DATA1			
		OUT DATA2			
		OUT DATA3			
		OUT DATA4			
		OUT DATA5			
		OUT DATA6			
		OUT DATA7			
		OUT DATA8			
		OUT DATA9			
		OUT DATA10	BANK1	Output echo of Bank Select 1 Input	
		OUT DATA11	BANK0	Output echo of Bank Select 0 Input.	

**4.7.2 Input and Output H/W Recommended Connecting Circuit**



All enFORCE inputs and outputs are active true low. All interface devices must accommodate active true low connection (NPN) for correct operation.

**!** When an input card with high input resistance is used, it may not normally receive OUT DATA signals depending on the external environment and other conditions.

Note that when Mitsubishi I/O composite cards #A1SH42 and #A1Sx42 are used, the above mentioned trouble may occur.

### 4.7.3 Input and Output Signal Explanation

#### ◆ Input Signals

Inputs are sourced (normally high) and activated when pulled low (0VDC).

- **START** : Cycle Start signal (Normally Open)

The unit reads the WORK SELECT signal and SELF-CHECK signal at the start ("OFF"-> "ON") of this signal and starts pressing. **This signal must be maintained until the cycle is complete.**

The press unit will be in BUSY (in cycle) status after start of press.

In the following conditions the READY output signal is turned "OFF", and the START signal input cannot be received:

- While stopping
- While resetting
- Bypass condition
- Abnormal condition

If the start signal is turned "ON" while in MANUAL mode, the press will perform the function defined in the MANUAL operation of the selected WORK SELECT. (See MANUAL and WORK SELECT chart on the following page)

**If the START input signal is turned off while in cycle the unit will stop and return as programmed in the RETURN OPERATION parameter.**

- **STOP**: Emergency Stop signal (Normally Closed)

This signal must be active (on) for controller operation. When it is inactive (off), controller operation will stop, press motion stops and input/outputs will be disabled. If the signal is turned off during a press cycle, press motion stops but the cycle data collected is retained. A judgment will be made based upon the limits set in the active parameter.

- **MANUAL**: Manual Mode signal (Normally Open)

While the signal is "ON", the mode is set to MANUAL.

If parameter 1 (no Work Selects are selected) is active, Manual+Start initiates home position search. If parameter 2 thru 8 is active, Manual+Start initiates the function shown in the chart on the following page.

A signal will not be accepted during a reset or when in cycle.

- **RESET**: Reset signal (Normally Open)

When active (on), this signal will clear all data and discrete outputs. A Zero Check of the force transducer will be performed. During the Zero Check, the ACCEPT or REJECT lamp will light to indicate the result of the Zero Check. If the system has been disabled by an ABNORMAL output, the system will not return to normal operation until the abnormal condition has been corrected. **This signal has to be input for 200~500ms.** Do not input this signal between cycles due to the potential for data loss.

If the reset signal is turned "ON" while in cycle, press motion stops.

- **SELF CHECK OFF**: Load Cell automatic check "OFF" signal

When this signal is "OFF" (or unconnected) at the time of inputting a START signal, the home-position voltage level and CAL voltage level of the load cell is automatically checked before the press cycle begins.

If the automatic check of the load cell is not required, turning "ON" this signal at the time of inputting a START signal will cause this test not to be performed.

**\*Allow at least 10ms from the time this signal is turned on before turning on the START signal. Do not turn this signal off at least until BUSY goes "HIGH".**

- **BYPASS**: Press off signal (Normally Open)

When active (on), all functions of the press controller are disabled and a BYPASS signal is output, making it impossible to start the press.

If the signal becomes active during a press cycle, the press cycle is stopped.

- **WORK SELECT 0 thru 4:** Parameter Select signal (Normally Open)  
These 5 inputs [WORK SELECT 1-4] form a binary code which is capable of selecting up to 32 different sets of press parameters.

\*Allow at least 10ms from the time this signal is turned on before turning on the START signal.  
Do not turn this signal off at least until BUSY goes "HIGH".

WORK SELECT 4	WORK SELECT 3	WORK SELECT 2	WORK SELECT 1	WORK SELECT 0	Param No.	MANUAL mode
OFF (OPEN)	OFF (OPEN)	OFF (OPEN)	OFF (OPEN)	OFF (OPEN)	1	Home-position search
OFF (OPEN)	OFF (OPEN)	OFF (OPEN)	OFF (OPEN)	ON	2	Home-position return
OFF (OPEN)	OFF (OPEN)	OFF (OPEN)	ON	OFF (OPEN)	3	Descent high speed jog
OFF (OPEN)	OFF (OPEN)	OFF (OPEN)	ON	ON	4	Ascent high speed jog
OFF (OPEN)	OFF (OPEN)	ON	OFF (OPEN)	OFF (OPEN)	5	Descent middle speed jog
OFF (OPEN)	OFF (OPEN)	ON	OFF (OPEN)	ON	6	Ascent middle speed jog
OFF (OPEN)	OFF (OPEN)	ON	ON	OFF (OPEN)	7	Descent low speed jog
OFF (OPEN)	OFF (OPEN)	ON	ON	ON	8	Ascent low speed jog
OFF (OPEN)	ON	OFF (OPEN)	OFF (OPEN)	OFF (OPEN)	9	(Home-position search)
OFF (OPEN)	ON	OFF (OPEN)	OFF (OPEN)	ON	1 0	(Home-position return)
OFF (OPEN)	ON	OFF (OPEN)	ON	OFF (OPEN)	1 1	(Descent high speed jog)
OFF (OPEN)	ON	OFF (OPEN)	ON	ON	1 2	(Ascent high speed jog)
OFF (OPEN)	ON	ON	OFF (OPEN)	OFF (OPEN)	1 3	(Descent middle speed jog)
OFF (OPEN)	ON	ON	OFF (OPEN)	ON	1 4	(Ascent middle speed jog)
OFF (OPEN)	ON	ON	ON	OFF (OPEN)	1 5	(Descent low speed jog)
OFF (OPEN)	ON	ON	ON	ON	1 6	(Ascent low speed jog)
ON	OFF (OPEN)	OFF (OPEN)	OFF (OPEN)	OFF (OPEN)	1 7	(Home-position search)
ON	OFF (OPEN)	OFF (OPEN)	OFF (OPEN)	ON	1 8	(Home-position return)
ON	OFF (OPEN)	OFF (OPEN)	ON	OFF (OPEN)	1 9	(Descent high speed jog)
ON	OFF (OPEN)	OFF (OPEN)	ON	ON	2 0	(Ascent high speed jog)
ON	OFF (OPEN)	ON	OFF (OPEN)	OFF (OPEN)	2 1	(Descent high speed jog)
ON	OFF (OPEN)	ON	OFF (OPEN)	ON	2 2	(Ascent middle speed jog)
ON	OFF (OPEN)	ON	ON	OFF (OPEN)	2 3	(Descent low speed jog)
ON	OFF (OPEN)	ON	ON	ON	2 4	(Ascent low speed jog)
ON	ON	OFF (OPEN)	OFF (OPEN)	OFF (OPEN)	2 5	(Home-position search)
ON	ON	OFF (OPEN)	OFF (OPEN)	ON	2 6	(Home-position return)
ON	ON	OFF (OPEN)	ON	OFF (OPEN)	2 7	(Descent high speed jog)
ON	ON	OFF (OPEN)	ON	ON	2 8	(Ascent high speed jog)
ON	ON	ON	OFF (OPEN)	OFF (OPEN)	2 9	(Descent middle speed jog)
ON	ON	ON	OFF (OPEN)	ON	3 0	(Ascent middle speed jog)
ON	ON	ON	ON	OFF (OPEN)	3 1	(Descent low speed jog)
ON	ON	ON	ON	ON	3 2	(Ascent low speed jog)

If the start signal is turned "ON" while in MANUAL mode, the press will perform the function defined in the MANUAL operation of the selected Parameter Number; "Home-position search", "Home-position return", "Descent jog" (Advance) and "Ascent jog" (Return).

The speed of the operation of MANUAL mode is set in the **Data Number OE: MANUAL SPEED** system parameter. (See Page 6-23) The speed of the "Home-position search", "Home-position return", "High speed jog" is set to this set value.



**If a value greater than 10mm/sec. is entered, the system will limit Home Position Search speed to 10mm/sec.**

The speed of the "middle speed jog" is set to 1/10 of this set value or the tool's minimum speed. The speed of the "low speed jog" is set to 1/10 of this set value or the tool's minimum speed.



**On a "Home Position Search", the ascent (return) operation operates first and when the CCW limit sensor turns OFF, the operation changes to descent (advance) operation. After the CCW limit sensor turns ON again, the motor will advance until the resolver location (in pulses) is at 0. This point is set to the zero point and becomes the home position. (See Section 7.2.3.2)**

### ◆ Output Signals

Outputs are rated at +12~24VDC, 200ma. When activated, open collector sink outputs (normally high) pull the input device low (0VDC).

#### OUTPUT BANK 1: Bank0 – Off / Bank1 - Off

- **REJECT: [OUT DATA7]** Press REJECT (NG) Signal  
Output when the press result exceeds the press limits. This signal turns on just before BUSY goes “LOW”.  
Output remains active until the start or reset signal is input.
- **ACCEPT: [OUT DATA6]** Press ACCEPT (OK) Signal  
Output when the press result is within the press limits. This signal turns on just before BUSY goes “LOW”.  
Output remains active until the start or reset signal is input.
- **ABNORMAL: [OUT DATA5]** System Abnormal/Abnormal Result  
Output when abnormalities are detected during a system check performed by the unit or during a press cycle.  
Output remains active until the reset signal is input.
- **READY: [OUT DATA4]** Input Enable Signal  
Output when the SAN Unit is capable of an input signal from external equipment, such as a PLC.  
  
READY output turns “OFF” in the following conditions:
  - During initial processing at powering up (for 5 seconds)
  - When in MANUAL mode
  - When an abnormal signal is output
  - When in Bypass status (when setting and during download communication).
  - While STOP signal is inactive
  - While in cycle, resetting and checking CAL
  - When operation of the press unit by an external input is impossible
- **BUSY: [OUT DATA3]** Operating signal  
When the press unit is in cycle, the signal is “ON”.
- **POS STOP: [OUT DATA2]** Return position stop signal  
Output when the press is stopping between home-position (0mm position) and the selected parameter **[62: Job Start Position]** when it is not in cycle.  
If the selected parameter **[62: Job Start Position]** is set to 10mm, the signal is output when it is stopping between 0 to 10mm.  
**\*When using “Load Return” Operation Finish Mode, POS STOP is output only when at home-position. (version 1.94 and higher)**



**Note that the press is not always resting at the home position (0mm). Caution should be taken when selecting different Parameter numbers. If the new parameter number selected does not have the same [62: Return Position], the POS STOP signal may go low (OFF).**

- **ORG OK: [OUT DATA1]** Home-position confirm signal  
Output after a home-position search has been performed and a home position has been defined.  
**\*Home Position must be defined before Automatic operation will be allowed.**
- **BYPASS: [OUT DATA0]** Press off status  
Outputs “ON” when the press is in the off status.
- **PRESS ADVANCED: [OUT DATA8]**  
Outputs when the press reaches the target load or target distance for a time that is set in **[61: Load Hold Time]**. The front display panel will show “d” when in recovery.



**Do not remove start signal until this signal goes low (OFF). If this happens, when the start signal goes high (ON) again, the tool will go back to target distance or load point then recover for the set time before continuing.**

































































































































































































































































